ALTERNATIVE VEGETABLE PRODUCTS FOR POTENTIAL EXPORT OR IMPORT SUBSTITUTION

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CONTRIBUTING PUBLICATIONS

HSBC Business Profile Series ARMENIA, First Edition, Second Quarter 1999

Michael Gylkhasyan, Yervand Grigoryan, Armen Petrosyan, Artavazd Hakobyan, John Macartney, The report of the Working Vegetable Group on Crop, Fruit and Vegetables Production ARMENIA, Food and Agriculture Organization, United Nations (FAO), June 2001.

Doyle Peterson, Bagie Sherchand, The Caucasus Regional Markets Analysis for Armenia Agribusiness Products, 2001

Imperial County GUIDELINES to Production Costs and Practices, 2000-2001, Vegetable Crops

Oscar Lorenz and Donald Maynard, Knott's Handbook for VEGETABLE GROWERS, Third Edition

The Packer, Sourcebook, 2002 Produce Services

Armen Movsisyan, Integrated Food Security Program (IFSP), Southern Armenia, Regional Climatic Information

Alpha Consulting, Glass Jars Demand in Armenia, Market Survey

ABBREVIATIONS

Armenian Small-Medium Agribusiness Enterprise Project (ASME)
Scope of Work (SOW)
Metric Ton (mt)
Hectare (ha)
Good Agricultural Practices (GAP)
United States Department of Agriculture (USDA)
Ministry of Agriculture (MOA)
Former Soviet Union (FSU)
Millimeter (mm)
Certified Professional Agronomist (Cp.Ag.)

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EXECUTIVE SUMMARY

The principal objective of this Scope of Work (SOW) is to assess and evaluate the potential for producing "alternative" vegetable crops, not presently produced in Armenia, for subsequent processing and sale into both domestic and foreign markets.

One of the major needs of this consultancy was to visit as many of the production area as possible in Armenia. Eight of the nine marz were visited, this allowed for exposure to the majority of Armenia's climatic and production areas.

Generally, the climate during the vegetable production season in Armenia is very similar to that found in the mid central valley of California. However, it should be noted that the spring and fall seasons in Armenia are cooler compared to that in California. During the summer season they are identical during some months. The rainfall data indicates that there not sufficient rainfall during the major production season to eliminate the need for irrigation. While Armenia receives more rainfall during the fall and spring seasons, it is not adequate for crop; however, it will act as a supplement.

That end, a considerable amount of time has spent traveling throughout the country conducting interviews with farmers, farmer representatives, marz staff members, and processors. We were able to have conversations in eight of the nine marz in Armenia. This has provided a very good reference concerning climatic and cropping differences that exist within the country.

During the site visits we conducted discussions with 30 different "lead" individuals. The primary purpose of the discussions was to establish a base for the production criteria of the traditional crops. This included gather information on the crops grown in the various areas, local climatic conditions during the growing period, varieties, if available (very hard to get), general plant spacing, seed and fertilizer information and the location of any processing facilities in the marz.

From these discussions it is very clear that there are several major constraints in the infrastructure within Armenia. From an overall perspective the most serious, is the complete lack of a cold chain system. This will present some challenges even for a program that is processor oriented. **If this were a fresh market program it would be the deal stopper.** In an effort help minimize the negative effects, crop trials (if implemented), should be located as close to the processing facility as possible.

The second major constraint to be dealt with is that of seed quality. I do not know how to express the degree of this problem other that to state that it is a disaster. There are no quality standards, or import requirements that protect the farmers against such poor quality seed. A local grower stated openly that if any trialling program were implanted it would be ill advised not to have the seed controlled by the ASME Project or by their client(s).

The third constraint is the fertilizer situation in Armenia. There field plantings where the farmer was using a complete fertilizer, nor were they applying the necessary quantity per hectare. Almost exclusively, they are applying only nitrogen (ammonium nitrate). Normally the application is made in the fall during the major plowing season. The question is, since most of the annual rainfall occurs during the winter months, much of the nitrogen could be leached out of the root zone, and not be available for the plants it is intended in the spring planting season.

Transportation, while an issue, particularly for those areas long distances from the processing facilities, is not as severe as cold storage, fertilizer or seed. There is land available within the areas

closer to the processing facilities. This constraint may become a factor if it is necessary to move selected very cool season crops out of the Ararat Valley area during the summer months. This is likely, given the maximum temperature possibility.
Potential crops include green beans, green peas, and possibly sweet corn. All three do not pollinate well at the maximum temperature given to us during the site visit. Some risk/reward analysis would be necessary.

There are not serious constraints that include soils, weather as potential alternative crops would fit into the existing parameters for traditional crops. However what is expected is that given an option, more of the alternative crops would do equally well in other selected marz during part of the year.

This issue of appropriate equipment for the new privatized farm size was mentioned several times at the local level. It is also discussed at dept in some of the background publications. However, given the current farm size this is something that can be lived with in the shot term or a start up trial program. In mid or long term however some changes would be required to maintain competive.

Field support to the farmers in Armenia over all was lacking. We were unable to find any supportive printed materials in the field. There were some used in the offices by local staff during our discussions. The completion of such material would be essential in any start up trialling program. The material should be written at the farmer level.

All of the crop development activity must be done in cooperation with defined processor client(s). The client, with the projects back up support, should take the lead in all operations, including seed orders, fertilizer, pest/disease control products, field extension support, transportation to and from the fields, and appropriate field harvest containers. An illustrative example of how this could be structured is located in the annex.

The processor client(s) will provide the selected growers with a mutually agreed growing contract, that specifies required crop quality, raw product delivery time line, and agreed to purchase price (Per unit, kg/mt) to the farmer. Further, it is recommended that the selected processor client(s) prepared written quality standards for the targeted vegetables, and that the standards become part of the agreement with the farmer(s).

During a potential trialling start-up program, due to lack of adequate cold storage, it is recommended that any trial locations be established as close to the processing facility as possible. This will help to minimize crop damage, due to field heat and transportation damage.

Time is very important if there is any desire to initiate any trialling during the 2002 production season. Many components have to be coordinated and probably a best-case scenario would be for some possible trial for a fall harvest. A time line located as section “M” provides more detail. Precise planning is not possible until a basic direction is decided, and thereafter if there is to be a program the necessary client(s) be identified.

During this consultancy it has been observed that the ASME Project appears to be designed primarily as a market directed and motivated. One would suspect that any interest in the alternative vegetable area would be to assist the project in achieving it’s required goals and objectives, and rightly so. However, should the project move forward and implement a trialling program for new vegetables crops, it is my opinion that additional technical support to the existing staff will be required. The desire from the projects point of view is to motivate the local processors to assume the leadership role in moving this activity forward and supplying the necessary support programs.

The safety of food at all levels has become probably the paramount issue in the United States and many other areas of the world. If one intends to export into any of these markets at any level they must be prepared to be in compliance with the regulations. Further, it only makes good business sense to insure your buyers have a safe product.

Many of the major buyers insist on an unbiased third party certification procedure. This is not limited to processing facilities only. All practices must be traceable back to a specific farmer and lot.

Good Agricultural Practices (GAP) are based on eight principals and practices associated with the minimizing microbial food safety hazards in the growing, harvesting, packing, and transporting of fresh produce.

There are approximately 15 operational canneries producing the above mentioned processed food products at different levels of technology and sophistication. Many of them are presently operating at about 10 to 15 percent of their capacity. Approximately three firms are using solar dryers, to carry out commercial dried fruit and tomato production. During this consultancy it was discovered that there are two dryers in the Syunik marz that are not being utilized.

There are many opportunities for the Agriculture Industry in Armenia. There are also some serious constraints that must be addressed including cold storage facilities, seed quality, and fertilizer. Others are presence but in my view these are the most serious. The real challenge for Armenian agribusiness is, to capture the opportunities, begin solving the constraints, and begin moving the country in a positive direction.

SCOPE OF WORK (SOW)

The Armenian Agribusiness SME Market Development Project (ASME) is designed to increase market opportunities for private Armenian agribusiness. As a part of the process leading to this goal, ASME will identify markets where existing and new agribusiness products can be sold, and develop strategies by which Armenian companies can take advantage of these opportunities. ASME will review and address constraints that interfere with the ability of Armenian firms to achieve growth in these markets, and will design and implement measures to alleviate those constraints.

At present, the assortment of vegetable crops produced in Armenia is quite small and generally limited to those traditionally utilized in the past. Most common are potatoes, carrots, beets, cabbage, tomatoes, cucumbers, and several varieties of peppers. Since the breakup of the of the former Soviet Union, domestic demand has grown to include additional non-traditional vegetables in varying forms (fresh, canned, and frozen), most of which are imported. Today, new opportunities have presented themselves in the form of domestic food processors wanting to expand their product mix in order to 1) sell directly into forgiven markets or at the vary least 2) displace those foreign offerings which challenge domestic markets.

The challenge is that processors are dependent on farms to produce new varieties. At the same time, farmers are dependent of the processors buy the new varieties. The problem is that neither knows what new alternative crops will climatically substitute for older, traditional crops.

An important "ripple" benefit of this activity is that the introduction of alternative crops also creates alternative opportunities for local farmers. At present, many of the traditional crops are over produced, creating a glut on the market. The same crops are sold at below the cost of production, or simply spoil. With alternative crops, farmers gain by potentially lengthening their growing season through addition or substitution of new crops for more traditional ones. At the same time, the same farmers can thus expand their income producing capacity.

OBJECTIVE

The principal objective of this Scope of Work (SOW) is to assess and evaluate the potential for producing "alternative" vegetable crops, not presently produced in Armenia, for subsequent processing and sale into both domestic and forgiven markets.

A. BACKGROUND

The Republic of Armenia is situated in the Caucasus region of the near east. The country encompasses an area of 29,800 square kilometers, an area roughly equivalent to Belgium. Armenia shares its border with Azerbaijan to the east, Turkey to the west, and Georgia to the north. To the south lies the Nakhichevan Autonomous Republic, a territory of the Azerbaijan separated from the remainder of that country but a panhandle of Armenia land extending to a 35-kilometer stretch of border with Iran. Armenia's topography is rugged highland plateau with elevations ranging from between 1,000 to 2,500 meters. The country's highest peak is mount Aragats at 4,000 meters. Armenia is also home to Lake Sevan, which, at 1,400 square kilometers (elevation 2,000 meters). The region is prone to occasional severe earthquakes; after the latest in 1988 the seismic construction standards were raised to a higher level.

The country's capitol, Yerevan, is located in the southern region, 15 kilometers from the Turkish border. Situated in the Ararat Valley, Yerevan and its soundings envirpns have a combined

population of just over half the countries 3.75 million people. Other major cities include Gumri, and Vanadzor.

The bulk of Armenia's fresh vegetables and fruits (except for grapes) are destined for the fresh market, a small portion, generally less than 10 percent at this time, make it to the processing industry. Available data indicates that domestic markets absorb a significant percentage of the fresh products through its major marketing outlet. Producers and suppliers also indicate that fresh products have thus far commanded higher prices versus the process markets, some indicate that this difference can be as much as 40 percent. Needles to say, producers prefer to first supply the fresh market and then the processed neither with surpluses that the fresh market neither can nor absorb.

Table 1 below provides the last available five-year data for selected products. The data includes total metric tons and the yield per hectare expressed in mt.

Table 1: Total Fruit and Vegetable Production and Average Yield

	1996		**1997**		**1998**		**1999**		**2000**	
	MT ('000)	**Yield MT/HA**	**MT ('000)**	**Yield MT/HA**	**MT ('000)**	**Yield MT/HA**	**MT ('000)**	**Yield MT/HA**	**MT ('000)**	**Yield MT/ HA**
Fresh Vegetables:	444.5	20.15	369.0	17.98	395.2	20.18	449.0	20.92	375.7	18.91
- Tomato	164.5	7.46	136.5	6.65	146.2	7.47	166.1	7.74	139.0	7.0
- Cucumber	31.1	1.41	25.8	1.26	27.7	1.41	31.4	1.46	26.3	1.32
- Eggplant	3.1	0.14	2.6	0.13	2.8	0.14	3.1	0.15	2.6	0.13
- Chili Pepper	5.3	0.24	4.4	0.22	4.7	0.24	5.4	0.25	4.5	0.23
Potatoes	423.2	*12.96*	359.8	*10.94*	440.0	*13.44*	414.1	*12.96*	286.6	*8.38*
Onion	43.1	1.95	35.8	1.74	38.3	1.74	43.6	2.03	36.4	1.83
Garlic	6.2	0.28	5.2	0.25	5.5	0.25	6.3	0.29	5.3	0.26
Grapes	*158.5*	*7.31*	*107.7*	*6.14*	*106.0*	*6.94*	114.8	*7.47*	*115.8*	7.80
Other Fresh Fruits:	158.2	4.77	108.8	4.51	126.7	6.05	88.1	4.04	127.6	5.88
- Apricot	24.6	7.4	16.9	7.0	19.7	9.4	13.7	6.3	19.8	9.1
- Peach	31.6	9.5	21.7	9.0	25.3	12.1	17.6	8.1	25.5	11.7
- Apple	59.5	17.9	40.9	17.0	47.6	22.7	33.1	15.2	48.0	22.1
- Cherries	5.6	1.7	3.9	1.6	4.5	2.1	3.1	1.4	4.5	2.1
- Plum	4.9	1.5	3.4	1.4	3.9	1.9	2.7	1.3	4.0	1.8

Source: (1) BSC, "Information on Domestic and Regional Market Assessment Activity for Armenia Agribusiness Activity" August 2001. (2) Armenia Agribusiness Development Center (ADC), September 2001.

Armenia has approximately 1.2 million acres of arable land. The agriculture sector employs one-quarter of the workforce and in 1997 contributed 28.2% of GDP. Crops produced include wheat, fruit, potatoes, and other vegetables. Approximately 14 percent of the arable land is planted in vegetables. The vegetable output in Armenia has dropped 16 percent during the five-year period noted above.

Tobacco, cotton, sugar beets and essential oils, such as geranium, rose and peppermint are also cultivated. The livestock and dairy sector is small but growing.

Viticulture is well established in the country and enjoys a good reputation in the international community. Production facilities include 35 wineries, three brandy distilleries and a sparkling wine plant.

Numerous valleys, particularly the Ararat River Valley contain rich soils that produce a variety of grains, including wheat and barley, root crops and fruit and vegetables. Arable land accounts for 17% of the land use; forested 12%, meadows and pastures 30% arid land 18%, with the balance

being mountainous terrain.

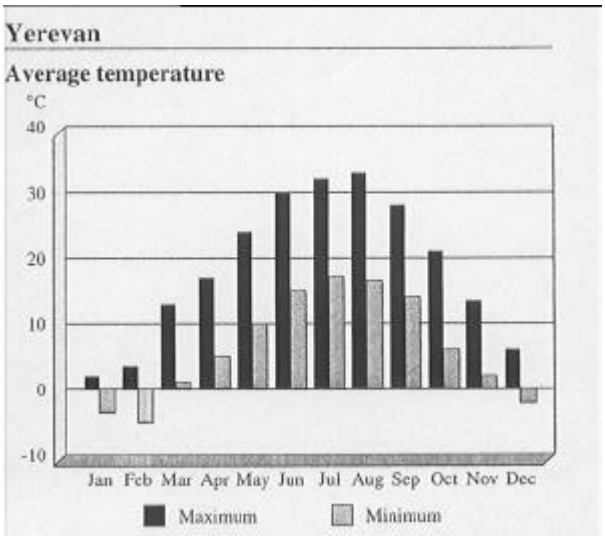
B. CLIMATIC SUMMARY

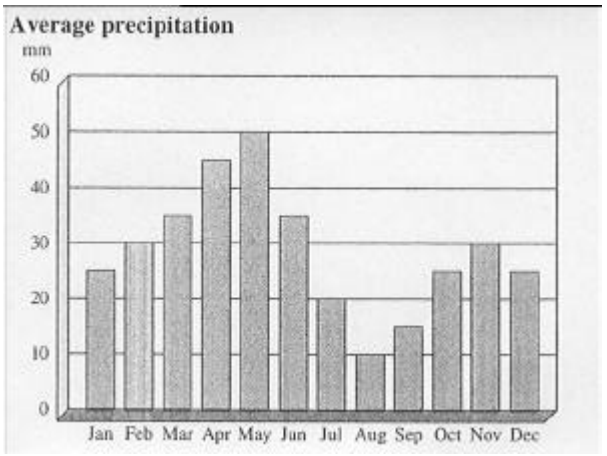
The climate in Armenia is highland continental, dry with four distinct seasons. The annual rainfall varies depending on a specific location but is between 1,200mm to about300mm in Ararat Valley. Temperatures can vary considerably also between seasons. The summer is generally pleasant with temperatures reaching 29^{o}C (84.2^{0}F), though the Ararat valley temperatures can climb to 40^{o}C (104^{0}F). Winters are cold with temperatures lowering to –5^{o}C (23^{o}F) in Yerevan, and colder in the Ararat Valley -30^{o}C (-22^{0}F) and the Lake Arpy area -46^{o}C (-50^{0}F).

Annual precipitation for the entire country averages 550mm (22 inches).

The following tables containing mean temperature and average precipitation, is summarized in

Table 2**:** below for Yerevan, Armenia.





In an effort to find some general weather for crop comparison purposes, it was decided that the mid farming region of California's central valley would be the most applicable. Table 3: below contains the summary of that information that includes mean temperature and rainfall per month. It should be noted that only the months between March and October are included. The reason for this decision is that it was concluded that the months included would be those of cropping season.

Table 4: Comparing selected climatic data between Yerevan and the mid-central valley of California. The numbers in the table are expressed in degrees Fahrenheit and inches.

Area	March		April		May		June		July		Aug		Sept		Oct	
	mean	rain	mean	rain	mean	rain	mean	rain	mean	rain	mean	rain	mean	rain	mean	rai
Modesto	55	2.1	60	1.0	67	.2	73	.1	77	.1	76	.1	72	.3	64	.7(
Merced	55	2.2	60	.88	68	.49	74	.1	79	.03	77	.02	73	.2	65	.72
Yerevan	42	1.3	55	1.4	64	1.7	71	.8	79	.4	77	.3	69	.4	56	1.1

This information confirms what was generally felt concerning a comparative area in California. Primarily, the mid central valley of California is very similar to Armenia, but Armenia is slightly cooler during the spring and fall seasons. This will effect the days to harvest for crops maturing during those times. The summer months are identical during some months The rainfall data also confirms the need for irrigation in Armenia. Little is any rainfall in the compared locations occurs during the three summer production months. However, during the spring and fall seasons in Armenia, the rainfall will assist in fulfilling the moisture needs of the crops thus requiring supplemental irrigation as needed.

A table providing easy temperature conversion is located in the annex. The temperature range in the table is from 15 to 135 degrees Fahrenheit.

TEMPERATURE CONVERSIONS - fahrenheit (°F) and celsius (°C)

°F=(°C X 1.8) + 32 °C=(°F - 32) + 1.8

°F	°C	°F	°C	°F	°C
15	-9.4	56	13.3	97	36.1
16	-8.9	57	13.9	98	36.7
17	-8.3	58	14.4	99	37.2
18	-7.8	59	15.0	100	37.8
19	-7.2	60	15.6	101	38.3
20	-6.7	61	16.1	102	38.9
21	-6.1	62	16.7	103	39.4
22	-5.6	63	17.2	104	40.0
23	-5.0	64	17.8	105	40.6
24	-4.4	65	18.3	106	41.1
25	-3.9	66	18.9	107	41.7
26	-3.3	67	19.4	108	42.2
27	-2.8	68	20.0	109	42.8
28	-2.2	69	20.6	110	43.3
29	-1.7	70	21.1	111	43.9
30	-1.1	71	21.7	112	44.4
31	-0.6	72	22.2	113	45.0
32	0.0	73	22.8	114	45.6
33	0.6	74	23.3	115	46.1
34	1.1	75	23.9	116	46.7
35	1.7	76	24.4	117	47.2
36	2.2	77	25.0	118	47.8
37	2.8	78	25.6	119	48.3
38	3.3	79	26.1	120	48.9
39	3.9	80	26.7	121	49.4
40	4.4	81	27.2	122	50.0
41	5.0	82	27.8	123	50.6
42	5.6	83	28.3	124	51.1
43	6.1	84	28.9	125	51.7
44	6.7	85	29.4	126	52.2
45	7.2	86	30.0	127	52.8
46	7.8	87	30.6	128	53.3
47	8.3	88	31.1	129	53.9
48	8.9	89	31.7	130	54.4
49	9.4	90	32.2	131	55.0
50	10.0	91	32.8	132	55.6
51	10.6	92	33.3	133	56.1
52	11.1	93	33.9	134	56.8
53	11.7	94	34.4	135	57.2
54	12.2	95	35.0		
55	12.8	96	35.6		

C. SOILS OVERVIEW

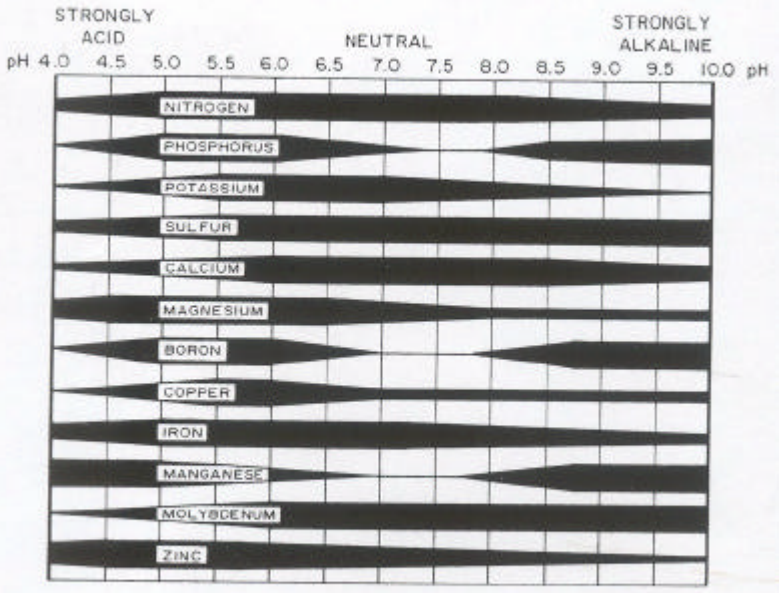
The predominant agricultural soils are various types of chernozem, which cover about 50 percent of the arable land in the country. These soils are in general reasonably fertile and deep, with high organic matter contents (4.9-7.5 percent) and good water-holding capacity. They are found most commonly at the middle altitudes (!,300m to 2,400 m). C hestnut soils cover about 14 percent of the arable area, mostly at lower altitudes (700 mt 1,700 m) and are open shallow and stony, with low organic matter contents (1.4 to 2.9 percent) and relatively low crop production potential. Mountain and meadow-steep soils are found at high altitudes (over 2,000 m), they have a high organic matter content (up to 18 percent) and are used primarily for pastures and meadow.

Overall, the agricultural soils are neutral or basic with pH from 7 to 9. Some 85 percent of arable land has a slope of less the 7 degrees and the steeper areas are often planted to perennial crops. The incidence of soil erosion is therefore limited. About 40 percent of the total land area is not suitable for agriculture.

Given the soil pH range noted above, some care should be exercised when determining fertilizer application rates as certain pH levels can affect the plants ability to utilize the elements in the soil. Table 5 below provides some guidelines in making these determinations. Generally however, elements are most available in a pH range of 6.5 to 7.5.

Table 5: The effect of soil pH of the uptake of elements from the soil.

EFFECT OF SOIL REACTION ON AVAILABILITY OF NUTRIENTS—Continued



Influence of pH on the availability of plant nutrients in organic soils; widest parts of the shaded areas indicate maximum availability of each element.

Adapted from R. E. Lucas and J. F. Davis, Relationships between pH values of organic soils and availability of 12 plant nutrients, *Soil Science* 92:177–182 (1961).

Armenia is divided into nine agricultural zones, while it was decided not to include that detail in this report; the material is located in the annex for those interested.

D. MAJOR VEGETABLE PRODUCTION AREAS

Vegetable cultivation is widespread most climatic zones of Armenia, covering about 14% of the total arable land. The traditional vegetables cultivated vary with altitude. In the lower altitudes, tomato, pepper, cucumber, eggplant and early cabbage are popular, while at higher altitudes there are primarily cabbage, carrot, and radish.

Between 1980-1992, the areas under vegetable crops, varying in some areas between 18,000-22,000 ha have not changed significantly. The cultivated area rose spectacularly in 1991 and, by 1992, it had increased to 26,000 ha by more than 43 percent, compared with 19900. Although overall production increased in the same two years by only 27 percent, the marketing infrastructure was apparently unable to handle the increase, resulting in considerable spoilage at the farm level. As a result of this experience, some 7,000 lowered the area in 1993 ha. Overall yields of vegetable seem to be very good. In the period of 1983-1992, mean yield was 26.7 mt/ha, with fluctuations between 26-34 mt/ha; the estimated yield in 1993 was 25 mt/ha. Tomatoes yield was better, achieving a mean yield of 36.1 mt/ha over the decade.

Crop production in the past has been variable, with large fluctuations, in part because of weather. Input supplies under the Former Soviet Union (FSU), although not optimal, were much better than they are presently and more stable from year to year. However, crop yields have been generally low, and even accounting for the country's agro-ecological conditions, the yields of the major crops is believed to be only **50-60** percent of their potential. This in part is probably due to the lack of good quality seed and the application of adequate fertilizer.

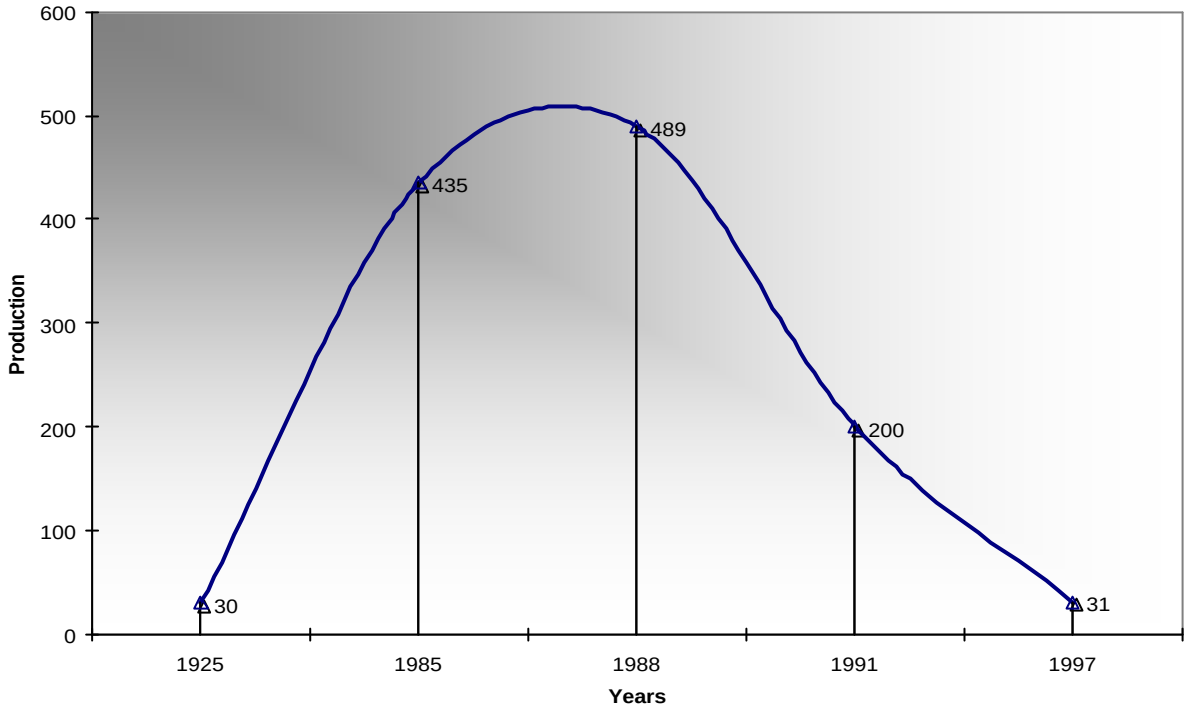
Watermelon, melon, pumpkin and squash are mainly produced in Armenia's Ararat Valley, within the Ararat and Armavir *marzes*. In the period 1980-1990, the areas under melon cultivation remained unchanged at 3,500 ha. In 1993, the area was decreased to 2,300 ha. This is a perfect marketing issue.

While most of Armenia's regions do produce vegetables, the four major areas for commercial sale production are as follows: Ararat Valley, Upper Ararat, and Armavir. Most of the production in other regions is produced for self or local consumption. Generally, 10% or less of the production finds its way into the commercial market. This level may be slightly higher during the winter months.

E. ARMENIA FOOD PROCESSING FACILITIES

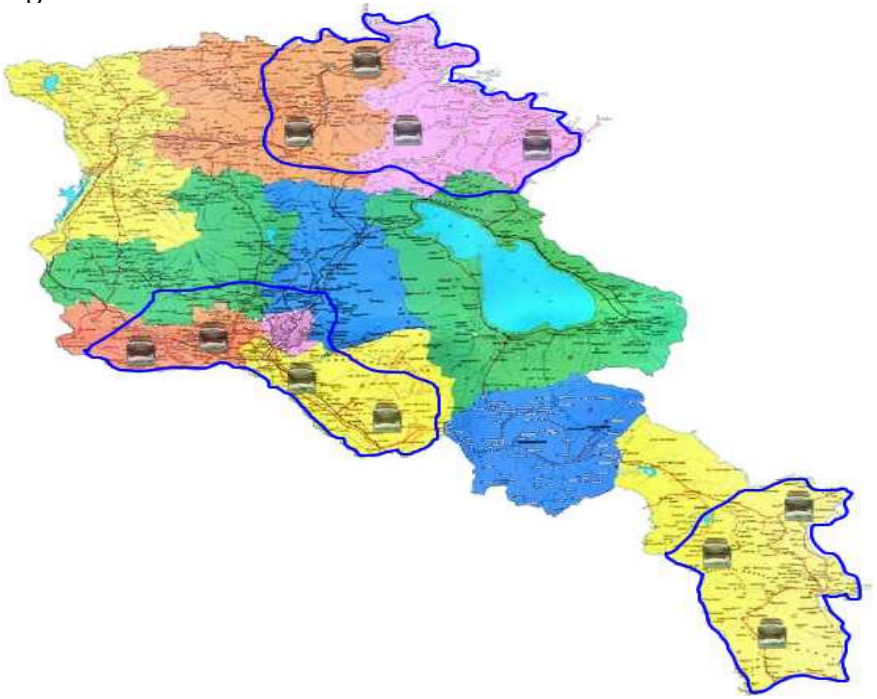
To date, Armenia manufacturers process a very narrow line of products. In the processed fruit and vegetables sectors (excluding beverages such as cognac, vodka etc), tomato paste and sauces lead the pack, followed by a select variety of fruit jams, fruit purees, fruit concentrates, jarred tomatoes, pickled vegetables primarily cucumbers, although other vegetables including green beans, and tomato are marketed widely in this form, jams and preserves, and dried fruits.

Figure 1: below dramatically illustrates the output of Armenia's food processing industry between 1925-1997 and the dramatic illustrates the effect of collapse of the Former Soviet Union (FSU).
Figure 1. Production of canned food: 1925-1997, in millions of conditional containers



There are approximately 15 operational canneries producing the above mentioned processed food products at different levels of technology and sophistication. Many of them are presently operating at about 10 to 15 percent of their capacity. Approximately three firms are using solar dryers, to carry out commercial dried fruit and tomato production. During this consultancy it was discovered that there are two dryers in the Syunik marz that are not being utilized.

Figure 2. Areas of main concentration of canneries



However, as reported by TACIS (2001), tomato pastes, apple juice concentrate, and fruit puree concentrate are the most important processed food products in Armenia at the present time.

A large percentage of the total processed fruits and vegetables supply the domestic market. However, domestic demand alone is unable to sustain the production. While domestic production of these items has slowly and successfully replaced imports, this is so only for products just mentioned**. There is room for major expansion and use of the processing facilities.**

F. FOOD SAFETY PROCEDURES

The safety of food at all levels has become probably the paramount issue in the United States and many other areas of the world. If one intends to export into any of these markets at any level they must be prepared to be in compliance with the regulations. Further, it only makes good business sense to insure your buyers have a safe product.

Many of the major buyers insist on an unbiased third party certification procedure. This is not limited to processing facilities only. All practices must be traceable back to a specific farmer and lot.

Good Agricultural Practices (GAP) are based on eight principals and practices associated with the minimizing microbial food safety hazards in the growing, harvesting, packing, and transporting of fresh produce. They are outlined as follows:

Principle 1. Prevention of microbial contamination of fresh produce is favored over reliance on corrective actions once contamination has occurred.

Principle 2. To minimize microbial food safety hazards in fresh produce, growers' packers or shippers should use good agricultural and management practices in those areas over which they have control.

Principle 3. Fresh produce can become microbiologically contaminated at any point along the farm to the table food chain.

Principle 4. Whenever water comes into contact with produce its quality dictates the potential for contamination from water used with fresh fruits and vegetables.

Principle 5. Practices using animal manure or municipal biosolid wastes should be managed closely to minimize the potential for microbial contamination of fresh produce.

Principle 6. Worker hygiene and sanitation practices during production, harvesting, sorting, packing, and transport play a critical role in minimizing the potential of microbial contamination of fresh produce.

Principle 7. Follow all applicable local, state, and federal laws and regulations, or corresponding or similar laws, regulations, or standards for operators the us, for agricultural practices.

Principle 8. Accountability at all levels of the agricultural environment (farm, packing facility, distribution center, and transportation operation) is important to a successful food safety program.

There must be qualified personnel and effective monitoring to ensure that all elements of the program function correctly and to help track produce back to through the distribution channels to the producer.

A copy of the complete Good Agriculture Practices (GAP) Plan is located in the annex material in a separate document. **However, its importance cannot be overstated if the growers and processors in Armenia wish to compete in the export market system.**

In addition to the major principles noted above, the United States Food and Drug Administration makes note of the following items worth a special look. Some special areas include the following:

Worker health and hygiene
1). Establish a training program directed toward health and hygiene. Include basics, such as proper hand washing techniques.
2). If employees wear gloves, be sure the gloves are used properly and do not become a vehicle for spreading pathogens, in other word kept clean and if necessary changed often.

Trace back
1. Documentation should indicate the source of the product and other information, such as date of harvest, farm identification and who handled the produce.
2.Growers, packers, and shippers should partner with transporters; distributors and retailers to develop technologies to facilitate the track back process.

All growers will be issued with a code number. This number must be included on each box of product harvested in the field. In turn the processor will transfer this number to the finished product. In the event of a problem occurring, the grower can easily be identified up to the point where the product is purchased in the market. This is all part of the growers responsibility, along with the processing operation, for "Quality Assurance".

The issue of trace ability was made in the recently completed Gulf Marketing report as being of major importance in the Gulf States. "Increasingly even retail chain stores want to be able to identify down to the farm level the source of the products they sell and to have the ability to identify which herbicides, pesticides, chemicals were used at what points in the growing cycle".

Washing
1.Poduce must be washed in clean, sanitized water to reduce pathogen populations.
2.Clean pallets, containers and bins before use and discard damaged containers.
Many food companies are currently using independent third-party inspections to boost the effectiveness of food safety programs, and increase the confidence level of their buyers.

G. TRADITIONAL CROPPING PROGRAM

Agriculture is an important sector in Armenia, accounting for approximately 22.5 percent of GDP and over 40 percent of employment (BSC 2001). The sector has the potential to contribute even more to the country's growth. Armenia's agricultural potential has yet to be realized.

On April 2, 2002 an exploratory trip was taken to the Syunik marz in southern Armenia. Specifically, site visits and discussion were held in Kapan, and Goris. Discussions included meetings with Ministry of Agriculture (MOA), NGO staff members, and farmer representatives. We

were unable to visit the Meghri area due to a storm that would not allow get trough the pass.

Other sites visits were conducted to the major areas of Armenia during the week of May 5, 2002

In total we visited eight marz in Armenia. This provided a cross section representation of the various climatic and production areas of the Armenia.

Annul rainfall figures for the years 1998, 1999, and 2000 in the Syunik marz are summarized in

Table 6: below.

Location	1998	1999	2000	Three Year Average
Goris	583 mm	520 mm	687 mm	596 mm
Sision	321 mm	411 mm	280 mm	337 mm
Meghri	233 mm	271 mm	287 mm	264 mm
Kapan	282 mm	487 mm	484 mm	418 mm

* Ministry of Agriculture, Kapan, Armenia, April-2002.

Following is a summary of vegetable crop activity for the respective areas for the Syunk marz.

1. Syunik marz

Kapan

Meetings were held with different groups in Kaplan. Included were the Ministry of Agriculture (MOA), Integrated Food Security Program (IFSP), and the "Kapan Entrepreneurship Development Center" NGO. All of our meetings were very useful and informative.

The area generally has 6.0 to 6.5 frost-free months per year (April 10 to September 25), meaning that given a satisfactory market, and the necessary crop inputs, many crops could be produced in the region. The elevation range is 600-1,800 meters. The temperature range during the production season is between 10^0C(50^0F) 40^0c(104^0F) Transportation, distance from major markets, and transportation in the marz is the greatest concerns.

The primary crops grown in the area include: cucumber, tomato, cabbage, potato, eggplant, carrots, and pumpkins. Tomato, cabbage, and eggplant are transplanted; all other crops are direct seeded. The normal production time is from April to October.

Other potential crops noted by the local authorities include green beans, parsley, sweet corn, green peas, broccoli, and brussel sprouts. All of the latter are grown on very small areas.

The primary constraints noted by the local staff were the lack of adequate operative irrigation systems. Production could be expanded if the constraint was removed. The average farm size is 1.4 ha. Within the marz. Approximately 85-90% of the local production is for home consumption; the remaining 10-15% is sold in the local market.

One or two local farmers sell transplants to the other farmers in the area. There are some low technology greenhouses in the area.

Other alternative crops noted by the local authorities include the following: green beans, parsley, sweet corn, green (garden) peas, broccoli, and brussel sprouts. The local farmers on a very small scale have produced a few of the potential crops.

During the course of our conversation with the Ministry of Agriculture (MOA) representatives it was indicated that the farmers in the local area could not supply the local demand for vegetables. If correct, this would cast a serious doubt as the possibility of producing for a market outside the Kapon region.

During our visit, we were able to obtain some basic production information utilized by the local growers. The information is located in Table 7 below.

Table 7: General cultural practices for some selected vegetable crops in the Syunik marz.

Vegetable	Variety	Seed/Transplant Source	Plant Spacing
Potato	Palma, Impala, Ausona, Sandra, Mona Lisa, Daskaselsky, Pilkulski Early	Local Production, Seed Producers, Imported	70 cm x 25 cm
Cabbage	Slava, #1, Amager, Kharkov Winter, Leninakan Late	Local Production, and Seed Dealers	50 cm x 25 cm early, 70 cm x 60 cm mid season, and 80 cm x 60 cm late season
Cauliflower	Guarantee, Movir	Local Production and Local Seed Dealers	60 cm x 25 cm
Tomato	Syunik, Never, Fakel, Masis, Lia, Armazd, Echmiadzin	Local Production, Local Seed dealers	80 cm x 25 cm early, 80 cm x 30 cm mid season and 80 cm x 35 cm late season
Squash	Anna, American	Local producers, Local Seed Dealers, Imported Seed	70 cm x 40 cm
Carrot	Nante, Chantini	Local Producers, Local Seed Dealers, Imports	45 cm x 20 cm x 6 cm
Pepper	Ani, Moldavian Gift, California Miracle, Last ochka, Nush 55, Likurishka	Local Production, Local Seed dealers	50 cm x 30 cm
Beetroot	Baurdaux, Egyptian Red	Local production, Local Seed Dealers, Imports	45 cm x 12 cm
Green Beans	Local Varieties	Local Production	60 cm x 12 cm
Garlic	Local Varieties	Local production	20 cm x 6 cm
Cucumber	Parade, Delphi, Concurrent, Kotsyk	Local production, Local Seed Dealers, Imports	80 cm x 35 cm

Eggplant	Avand, Yerevan	Local Production Local Seed Dealers	50 cm x 30 cm
Onion	Khatunarkh, Karatalsky	Local Production, Local Seed Dealers	45 cm x 20 cm x 12 cm

* A staff agronomist of the "Kapan Entrepreneurship Development Center" NGO Kapan, Armenia, provided the above information.

In addition to the conversations with local MOA and NGO staff, we were able to conduct a site visit with a prominent local farmer. He provided a different point of view to some of the local issues. The majority of the production issues were similar to those outlined above.
However, the farmer indicated that growers in the local area could supply all of the local needs if there were better marketing options, and local government officials did not encouraged farmers to plant cereal crops in the place of vegetables. However, until the marketing issues are addressed, there is probably much less risk involved in producing cereal crops.

The availability of fertilizer in the area is limited to nitrogen sources, 32-34% nitrogen ammonium nitrate. The officials indicated that neither commercial sources of phosphorous or potassium were used. These elements were supplied in the form of animal manures. The applied manure rates applied were 30 to 40 tons per hectare range. If the farmers are using ammonium nitrate as their nitrogen source, the manure rate may be excessive, as the primary purpose is to supply phosphorous, potash, and minor elements.

A local seed dealer was identified during the conversations. She is located in the local market and was kind enough to provide a partial list of the seed that she sold. Crops sold include coriander, garden cress, parsley, basil, mint, radish, onion, tomato, cucumber, marrow, beetroot, eggplant, watermelon, carrot, and fennel. The seed is sold in small quantities, i.e. 10 to 20 grams per sale. Seed quality remains a major question.

Goris/Sision

The average elevation in the Goris area is 1,400 to 1,600 meters. The average temperature during the growing season is between 26 to 28 ^{0}C (82.2^{0}F). Annual rainfall average for the latest three-year period is 596 mm.

The average farm size in the region is 2.2 ha. with a range of .8 to 2.8 ha. There is a total of 16,000 arable hectares in the region with 680 ha of vegetable production annually. In addition, there are about 1,000 ha of potatoes produced annually in the Goris area. The Goris region has about 4,000 farmers. Most of the production is consumed in the area, however, possibly 15 to 20 percent finds its way into the commercial market place, particularly during the mid summer.

Crops produced in the area include cabbage, tomato, cucumber, marrow, green beans, potato, carrot, bell peppers, local greens (including lettuces, water cress etc.), and garlic. New crops that were specifically mentioned by the local authorities include okra, and asparagus, and others that may be identified with a market demand. Tomato, cucumber, and potato are double cropped; the remaining hectares are single cropped. The area is reported to be the best green bean area in Armenia. All of the cultural operations except the "heavy tillage" are done manually, including planting.

There are 1 or 2 local greenhouses producing the majority of the transplants for the region. Crops that are transplanted include cabbage and tomato. All other crops are direct seeded. The general row spacing is 60 cm between rows x 25 cm in-row.

The recommended application rates (not necessarily those applied) should be determined by soils analysis but generally; the fertilizer program is as follows:

Potato receives the following amounts: 350 kg/ha.no3 400-450 kg/ha. p_2o_5, and 160-200 kg/ha k_2o. All other crops receive 300-kg/ha no_3, 400-kg/ha p_2o_5, and 150-kg/ha k_2o In addition the above fertilizer up to 40 mt of manure are applied. This seems excessive.

We also were able to visit a local asparagus planting in the area. It is planted with a wild variety. There are two wild varieties; one a thin one and the second variety is a thicker diameter variety. This planting was all planted to the thin variety. The planting is about five years old, and therefore, it should be in full production. Reportedly the farmer is not experiencing any sales difficulties.

The farmer however, was not available. While the variety may well suit the local market, it is very doubtful that it would compete in an export situation.

The most serious constraint noted by the local authorities was transportation in and out of the area. There were no serious issues concerning seed availability or fertilizer mentioned.

Reportedly, there are no issues in the Goris area with contamination from mining activities. This is not the case in parts of the Syunik marz.

There are two local processing facilities in the area; however, both are inoperative at the present time. The facilities are equipped to process in jars only, with probably very old equipment. While we did not visit either of the facilities, there is the possibility that the larger processor could set up a satellite plant in this area and process the raw product locally, then transport the finish product to Yerevan. This could be accomplished in by either ownership of the facility, or by a "private label" packing arrangement. This would allow for consolidation of smaller production with that in the Ararat Valley. Further, processed products would be transported instead of raw product which is much more perishable and prone to injury during transport.

Meghri

The general elevation of the area is about 670 m. The average rainfall is 300 to 350 mm, and the average temperature is -1^0C(30^0F) to 40^0C(104^0F)

The vegetables produced in the area include cabbage 1,000 ha. cucumber 400 ha., tomato 300 ha., beetroot 100 ha., carrot 100 ha., onion 200 ha., garlic 1,00 ha., bell peppers 100 ha., eggplant 100 ha., others 400 ha., and potato 3 ha.

The production season is from March to November, with 300 frost-free days per year, characterized with mild winter, dry hot summer, and long fall.

2. IJevan (Travush marz)

The elevation of the region is 600 to 2,000 m, with the majority of the crop production being in the 600 to 1,000 m range. The average rainfall in the area is 600-700 mm annually. The temperature range in the region during the growing season ranges between 6^0C (42.8^0F) and 37^0 C (98.6^0F). The heaviest frost occurs during January and February. Reportedly there are 10 frost-free months per year. However, looking at the elevation and rainfall leads me to question those months.

The area reportedly has 20,000 hectares that could be irrigated. There are 93,000 arable hectares in the region. The crops are irrigated with a modified flood irrigation system.

Crops produced in the area include the following: potato, tomato, green beans, cucumber, eggplant, and bell pepper. Tomato, eggplant, and bell peppers are transplanted; the remaining crops are direct seeded. Generally, local farmers in very low technology greenhouses, produce the transplants for the areas farmers. The direct seeded crops are planted beginning in early May, and they generally produce one crop per year. The transplants are planted approximately 4-6 weeks later.

The fertilizer use is limited generally to ammonium nitrate and manures. No phosphorous or potassium is applied.

There is no processing facility in the marz.

All of the farming operations are preformed manually, except the heavy tillage, i.e. plowing.

3. Vanadzor (Lori marz)

The elevation range for the marz varies between 450 to 2,000 m, with an average elevation of 1,600 m. given the average elevation; more of the area must be on the higher side. The general temperature range is as follows: spring, 7-12^{0}C (44.6^{0}F), and summer, 17 to 25^{0}C (62.6-77^{0}F). The average temperature is 24 to 28^{0}C (75.2-82.4^{0}F). The average annual rainfall was not available.

The number of hectares of annual vegetable production is about 1,600 ha. Cabbage occupies approximately 1,200 ha. (75 %) The total arable land area is 11,000 ha. Under the current irrigation system, about 5,000 ha. can be irrigated, maximum.

There is an interesting thing developing in this marz that has not been mentioned in any others. Land consolidation is taking place. Farmers are renting neighboring property under several business arrangements including share cropping and cash rent. This is allowing for larger farming units to appear.

While the marz average size is stated at about .7 ha, there are farms that are 5 to 6 hectares in size. With a few farms even larger. This indicates that there are apparently no major policy issues in effect that affect the land usage issue.

The major vegetable crops include cabbage (75%), tomato, peppers, cucumber, green beans and local greens broccoli and cauliflower possible crop alternatives for the area.

The primary fertilizer utilized in the Lori marz is ammonium nitrate (from Georgia), and manure. Manure is becoming more scarce as it is increasingly being used a fuel source. The local representatives indicated that on the average, 80% of the arable land receives no fertilizer for any crop. Cabbage receives the highest levels, about 60% of its actual need. The cabbage in the area yields average 11 to 13 tons per ha, or one third of the potential, if it were grown under more desirable conditions, the yield would increase three fold. Potato receives about 40 to 45% of its requirements.

Most of the seed in this marz, like the others visited to date, is locally or self-produced. We were told that there are not restriction on seed importation and no customs fees.

4. Ararat Valley (Ararat marz)

- Green flow Ltd

A greenhouse operation used primarily for winter production of several vegetables including tomato, cucumber, lettuces, broccoli, leeks and greens. The greenhouse season is winding down and the crops are being moved to open field production. The greenhouse facility encompass 7,500 m^2, and the open area are .5 ha. **This is a good indication of where the economics lie in the domestic vegetable market. It would also be a good indicator of the farmers business ability.**

The farmer is producing some of the "roma' types of tomato in addition to the conventional fresh market varieties. This variety has higher solids levels.

The grower re-stated very clearly the need to control the seed quality in some kind of internal manner. Seed quality reliability in Armenia is very questionable at best. He is importing his seeds from Holland, and Israel.

The farmer uses fertilizer that is currently imported from Holland. He uses heavier amounts in the greenhouse versus his open production suspect that this is related to the pricing structure of winter versus the summer market prices.

There were eight different fertilizer mixes available, with 12-10-18 being a popular choice. In addition, a complex blend is available from the Ukraine, with a mix ratio as follows: 20-20-20, this would work for the open field production. Plans are being made to import 150 mt of the mixed noted above from the Ukraine. Also available for use is treble super phosphate, and sulfate of potash. There is also a complex mix in Russia of 25-25-25, but it is not currently available in Armenia.

Artashat Cannery

Currently, the primary focus of this operation is on tomato paste, puree, cucumber (pickled), and some fruit juice products. Based upon our conversation with the director, unless some outside body is willing to underwrite the entire development cost of any new products, including crop development, label development, packaging materials etc, they really want to stay with what they are currently doing. They appear to be very happy with the status quo.

- Ararat Support Center

The elevation in this area is 750-800 m. The mean annual temperature is 15^0C(59^0F), with a variation of -3^0C(27^0F) (minimum of -5-10^0C(15-23^0F)- in the winter, to 35-40^0C(95-104^0F during the summer. The maximum temperature will make it necessary, at least for some crops, to produce spring and fall crops in this area. The average annual rainfall in the area is 300-350 mm, among the drier in Armenia.

The average farm size in this area is .4 ha. Crops produced in the area include the following: tomato, peppers, eggplant, soft skinned squash, watermelon. New crops that are increasing in planted area are green beans, sweet corn, spinach, cabbage, chinese cabbage, and dry beans. The corn varieties currently planted includes yellow, white and bi-color types. The varieties are Ambrosia, Incredible, and Ajenta. One metric ton of sweet corn seed has been ordered from Greece for planting this year. The planting spacing for the vegetable crops is generally 30 cm x

30 cm; generally, this appears to be a closer spacing compared to other areas in Armenia.

They are currently building a small cannery in the area; it should be ready in about two months. This could be a crop trialling source for the near future.

Most of the fieldwork in the vegetables is completed manually, except for heavy tillage.

5. Shirak marz (Gyumri)

The average elevation of the marz within the farming area is 1,500 to 1,600 meters. The mean daily temperature during the growing season is between 18 to 20^0C(68^0F), with a maximum being 32^0C(89.6^0F). The average annual rainfall ranges between 650 to 750 mm.

The growing season is between 90 to 100 days per years frost-free. The first frost in the fall is usually between September 13 to 15, and the last frost in the spring is approximately June.15.

There are 86,000 arable hectares in the marz, with 2,000 ha. devoted to vegetable crops. All of the vegetable area can be irrigated. There are 25,000 irrigated hectares within the marz. The average farm size varies between .5 ha to 25 ha, depending on the location. The larger areas are generally in the mountains. The leading crop is potato, followed by carrot, beetroot, cucumber, cauliflower (Super Max), and cabbage.

The planting periods by crop are as follows: beetroot, late April/early May, cucumber, late May, cabbage/cauliflower, transplant late June, carrot April or as soon as the land permits (after the winter rains), and potato April 20. Generally the crops are late this season due to the wet cold weather. The total vegetable area is 2,000ha. There is no processing facility in the marz.

Fertilizer is applied at the rate of 400 to 600 kg. /ha. The amount applied is generally determined by the farmer's ability to purchase. If the farmer cannot afford to purchase commercial fertilizer, they apply manure at the rate of 40 to 45 mt/ha. The fertilizer most commonly used is ammonium nitrate. The cost for the fertilizer is dram (ARD) 4,000.00 per 50 kg, or Dram (ARD) 80.00 per kg.

The seeds used are obtained from Gyumri seed selection, a state owned organization. They also plant imported seeds from Holland, and Bulgaria.

This marz, with more farmers in attendance, was able to provide the best overall picture of the input status.

6. Armavir marz (Echmiadzin)

The elevation range in the marz varies from 1,000 to 1,100 meters. The temperature during the growing season ranges from 10-15^0C(50-59^0F) to 40+0C(104^0F). Reportedly, all crops in the marz are irrigated therefore; the rainfall information was not available.

There are 54,000 arable ha. within the marz approximately 6,300 ha are devoted to vegetable crops. This figure used to be 20,000 ha. The primary crops are potato, 1,200 ha., cabbage 225 ha., cucumber 814 ha., onion 1,100 ha., melons(all types) 2,500 ha, tomato makes up most of the remaining area. The crop production cycle is normally from April to October. There is some "double cropping" but usually comes after wheat. There is also some "double cropping" following potato, generally with tomato or cucumber. Most of the fieldwork is completed manually. The crop

spacing for the major crops are as follows: potato, 70 cm x 50-60 cm, melons 1.8 m x 40-50 cm, and tomato 90 cm x 15-20 cm.

The only fertilizer used in the Armavir marz is ammonium nitrate, 33%. It is applied at a rate of 250 to 350 kg/ha. There is also some bio-humus used, it is normally applied at the rate of 3-5 mt/ha.

The seed situation is basically the same as we have experienced in the other area of Armenia.

7. Kotayk marz (Abovian)

The general elevation in the production areas of the marz ranges between 900 to 1,700 meters. The average temperature during the growing season is between 20 to 25 ^{0}C(68-77^{0}F). However, it can reach 30 to 35 ^{0}C(86-95^{0}F) on occasion. The rainfall is about 450 mm annually.

There are 39,00 arable hectare in the marz, with 23,000 ha for possible irrigation. The average farm size varies from .5 to 5-7 ha depending on its location in the marz. The mountain areas are usually larger.

The production season is relatively short with FROST being a potential problem. The first frost occurs generally by mid-September, and the last frost around mid-May. Therefore, there is a growing season of 110 t0 120 days, the latter being the maximum.

They also only use ammonium nitrate, no phosphate or potassium are applied

The seed situation is the same as other areas.

- Gamma Cannery

This production season will be the canneries first year of operation. They will process only fruit during this season.

The vegetables that they would like to begin operation with include the following: eggplant, capers, asparagus, peppers (red/green), and stuffed peppers.

They plan to market in NIS, Europe, and eventually the United States.

As they are not processing vegetables this season, most of the discussions evolved around the establishment of good grower relationships and grower contract. In addition, the establishment of acceptable quality standards was also discussed and all agreed that the standards should be established earlier rather than later.

8. Aragatzotn marz

- Tamara Cannery

The cannery began operation during the 2001-growing season. During the first year of operation, they processed the following items: strawberries, peaches, apples, apricots, figs; vegetables included eggplant, beans, cauliflower, peppers (green/red), and some mixed vegetables for pre-prepared uses. There are numerous possible combinations of dehydrated vegetables in the market.

New items of particular interest include broccoli, and asparagus; however, they are interested in

other options as well. The possibility of melons, baby vegetables, sweet corn, squashes, beans, and green peas were discussed. There appears to be a problem with the melon variety the cannery purchased last year both in sugar content (they are looking for a minimum of 10%) and texture. Some variety trialling would probably be worthwhile combined with other efforts.

Their processing season begins by June 1 and runs until November 30, or a six-month run.

They have submitted a growing contract to a "lead" grower for approval, the management is in complete agreement with what the ASME Project is attempting to accomplish concerning processor/grower relationships. The lead grower is attempting to organize a strawberry growers association that would in the future negotiate terms for that specific crop with the processor. The processor feels that the association would provide more consistent quality from the field

Table 8 below summarizes some of the major categories from each of the marz that were visited during this consultancy. The items include the following: elevation, rainfall, average temperature during the growing season, hectare in vegetables, and the average growing season expressed in months/days.

Table 8: Summary of selected growing criteria.

Marz	Eleva m	Rainfall mm	Mean ^{0}C temp/growing	Vegetable area ha.	Growing season/days/months
Syunik					
Kapan	600-1,800	418	10-40		7-8 /200-225
Goris	1,400-1,600	596	26-28	680	7-8 /200-225
Travush	6,00-1,000	600-700	6-37		10 / 300
Lori	450-1,600		7-12		
Ararat		750-800	25-40		
Shirak	1,500-1,600	650-700	18-20	2,000	3-3.5 / 90-100
Armavir	1,000-1,100		12-40	6,300	6-6.5/ 180 days
Kotayk	900-1,700	450	20-25		
Aragatzatn			Max 30		3-4 / 110-120

9. Other Observations/Comments

The question should be asked, whether or not selected "traditional crops" could better utilized in the processing industry to accomplish stated goals/objectives, if some very minor adjustments in their cultural practices were to be implemented. Specifically, carrot, tomato, and possibly potato are very strong candidates for this possible action. It has been stated that the carrots in Armenia are produced by a very large variety that does not lend it's self to cross slicing, and secondly, it was reported in the latest "Gulf States, Marketing Opportunities Report" that Armenian tomatoes did not contain sufficient level of soluble solids. These are, almost certainly, variety issues that can be easily solved.

It is possible that potato could be canned or flash frozen in some form of value added product(s), i.e. French fries, hash browns etc. Variety issues would need to be explored before moving forward. Very probably, Armenian processors could encounter this same issue in other export markets.

While it is well known that there are nine production regions in Armenia, it is also true that the present time the great majority of the commercial vegetables are produced in three or four of these regions.

A map of Armenia with the located of all of the site visits is located in the annex.

H. POTENTIAL ALTERNATIVE CROPS FOR ARMENIA

Currently several projects or organizations are supporting the trialling of new vegetables crops in Armenia. Some of the specific cultivars mentioned during the discussions include the following: sweet corn, broccoli, cauliflower, baby corn, brussel sprouts, snow peas, red cabbage, fennel, oregano, and sage. The sweet corn trial (USDA) was also supported by a marketing plan; a copy is located in the annex materials.

After meeting with many people including processors, growers, marz staff members, and other project staff members working on the subject of alternative crops, the following list of potential crops has been compiled. Please note, that those crops that appear below the line are traditional, and different processing methods versus their normal use.

Crop	Usage
Green Snap Beans	Fresh/Canned/Frozen/Pickled
French beans	Fresh/Frozen/Canned/Pickled
Snow Peas	Fresh/Frozen
Sugar snap Peas	Fresh/Frozen
Sweet Corn	Fresh/Canned/Frozen
Melons	Fresh/Frozen
Asparagus	Fresh/Canned/Frozen/Dried
Artichokes	Fresh/Pickled
Broccoli	Fresh/Frozen
Cauliflower	Fresh/Frozen/Pickled
Spinach	Fresh/Canned/Frozen
Brussel Sprouts	Fresh/Frozen
Fresh Green Peas	Fresh/Canned/Frozen
Baby Corn	Fresh/Canned/Frozen
Baby Carrots	Fresh/Frozen
Baby Eggplant	Frozen/Fresh/Canned
Baby Greens (salads)	Fresh/Frozen***
Okra	Fresh/Frozen
Cherry Tomatoes	Fresh/Pickled
Mixed Greens	Fresh/Frozen
Parsley	Fresh/Dried
Carrot	Fresh/Frozen/Dehydrated
Beetroot	Fresh/Pickled
Potato	Fresh/Canned/Dehydrated/ Frozen**
Tomato	Fresh/Canned/Pickled/Relishes*
Onion	Fresh/Dehydrated/Frozen*
Peppers	Fresh/Frozen/Dried
Cucumber	Fresh/Pickled/Relishes*

*Normally, different varieties are often used for different finished product lines.
**High value processed French fries and other convenience potato products.
***Illustration of these items is located in the annex.

Assuming that this effort may develop into a full or semi-commercial enterprise, it may be worthwhile to introduce some new concepts for possible future use. These include the use of plastic culture of various types that can be utilized to produce transplants, crop production or possibly expend the season of some crops. There are several other plastic techniques that can be incorporated into the production system in the future.

1. Transplant use in Armenia

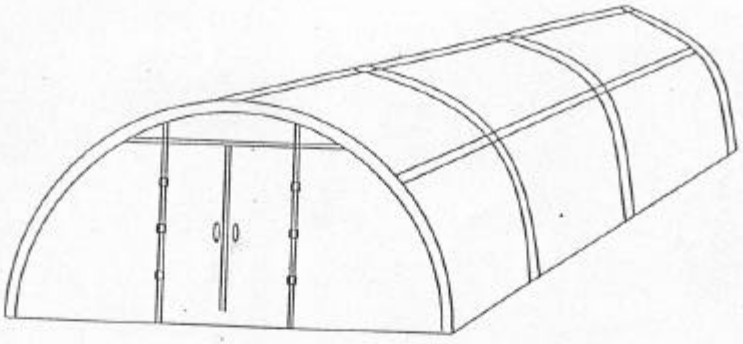
The use of transplants is a widely utilized technique in many areas of the world including Armenia. The technique offers some advantages that include the following: offers the ability to offset some weather delay issues, the grower should be able to maximize his plant population per planted area, elimination of thinning costs, and offers the possibility to plant more crop acres per growing season.

The necessary plants can be procured in a variety of ways. These options include the following: A number of plastic greenhouse designs, in an open-air environment, or in plastic grow tunnels in a bed. It is likely that many growers would elect to use the grow tunnel as it is less expensive. However, it should be noted that the single cell transplant system used in most greenhouses would provide less root damage during the transplanting operation versus the bare root system from a bed. This leads to a faster recovery from any transplant shock, and allows the plant to begins it's life cycle faster.

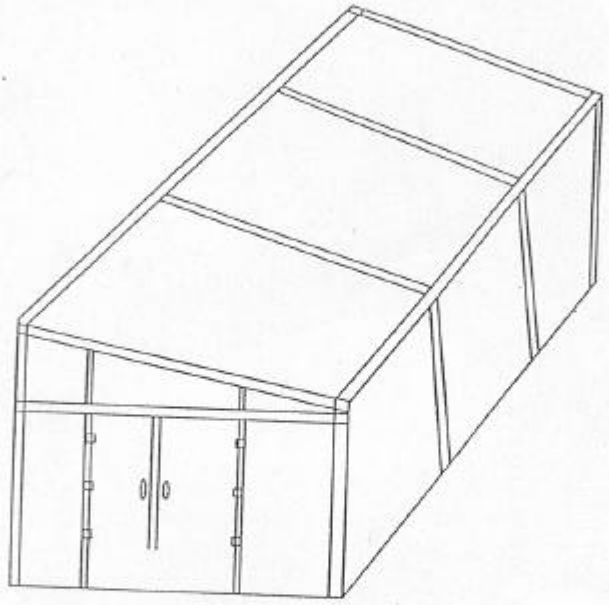
During the initial trially program and possibly later, it is anticipated that any transplant would be produced by a commcial operator already in business in Armenia. However, if this program is successful, no doubt at some point in time in the future other facilities may be required. Therefore, the following discussion and accomping illustrations are being included in this report.

Illustrative drawings of the potential types of low cost plastic green houses are as follows:

FIGURE 1. TYPES OF PLASTIC COVERED GROWING STRUCTURES

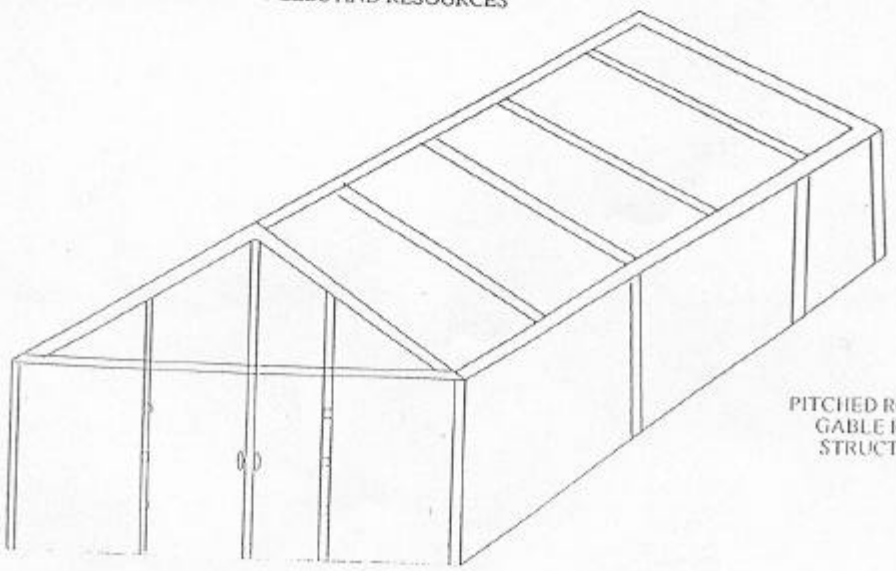


HALF CIRCLE
PIPE STRUCTURE



SIMPLE LEAN TO
WOOD OR PIPE
STRUCTURE

SIZE DEPENDENT ON NEEDS AND MATERIALS
COVERING MATERIAL POLYETHYENE, POLYETHENE
HEATING DEPENDENT ON NEEDS AND RESOURCES



PITCHED ROOF OR
GABLE ROOF
STRUCTURE

It is recommended that transplants only be used that are grown in individual cells and not bare-root. The low cost green house option is the best investment**.**
Table 10**:** illustrates the cell size best for some selected vegetable crops.

Vegetable	Cell Container size inches
Asparagus	1.5-3.0
Broccoli	1.0-3.0
Cabbage	1.0-2.5
Cauliflower	1.0-3.0
Cucumber	1.5-4.0
Eggplant	1.5-4.0
Melon	1.5-4.0
Tomato	1.5-6.

Table 11 below provides general information concerning the time required to grow the transplants in a greenhouse ahead of transplanting. The numbers represent the approximate days from sowing in the greenhouse to being ready for transplanting.

Table 11: Provides the approximate number of weeks necessary to produce transplants of selected vegetables.

Vegetable	Number of weeks
Artichokes	6-7
Broccoli	5-7
Cabbage	5-7
Cauliflower	5-7
Celery	10-12
Cucumber	3-4
: Eggplant	6-8
Lettuce	5-7
Melons	3-4
Onions	10-12
Peppers	6-8
Summer squash	3-4
Tomato	5-7
Watermelon	3-4

It is very important to note that if it is planned to transplant onions, celery, peppers more planning is required due to the time required to grow the transplants. Asparagus also falls into this category, if the transplant method of establishing asparagus is used.

Plants vary in their receptiveness and ease of adjusting to transplanting. **Table 12:**below offers some guidance as the comparative ease or difficulty of transplanting for selected vegetable crops.

Easy	Moderate	Require Special Care
Beet root	Celery	Sweet corn
Broccoli	Eggplant	Cucumber
Brussels sprouts	Onion	Melons

Cabbage	Pepper	Summer squash
Cauliflower		Watermelon
Chard		
Lettuce		
Tomato		

Two reports addressing the subject of vegetable transplants and the use of plastic in assisting crop production can be found in the annex.

There is a technology that may be used to extend selected vegetables in Armenia. In fact it appears to be in some use today and with some equipment changes it could be used on a larger basis. This technology while probably not adapted to widespread use currently or possibly during the current project term, may be useful in the future. The grow tunnel design and equipment is located in the attached annex materials. Two different machines are included in the separate annex document. The drawing that illustrates this system located below is the American version. A copy of the brochure is located in the annex.

I. MARKETING OPPORTUNITIES

1. Processing

Armenia's agricultural production capacity stands as a beacon for its processing sub-sector. After the virtual collapse of this sub-sector in the early 1990's, food-processing industries are now on the rebound demonstration business/investor confidence in Armenia's potential as a new source of raw material. Armenia's production of processed foods is increasingly fulfilling domestic demand as well as providing some exports. The amount exported in recent years is said to be a fraction of what Armenia used to process and export when it was part of the FSU.

Traditionally, Armenia was a key supplier of agro-processed goods to the Former Soviet Union (FSU). During that period of time, Armenia produced a variety of processed food products, such as caned vegetables and fruits, fruit juices, and tomato concentrate. Most of the processing was carried out in large facilities. About 80% of the products produced were exported to the FSU. However, after the demise of the Soviet Union, exports fell and the volume of production fell dramatically, well over 70%, shutting down plants and canneries. As external demand for processed foods dropped, production of raw material declined as well.

The impact of this loss of market was the most severe on Armenia's fruit sub sector as orchards and vineyards were either cleared or seriously neglected.

Armenia has slowly begun to recover and re-establish the food processing industry. The production sector is responding as well, as orchards and vineyards are slowly being rejuvenated. Consequently, an increasing share of the fruits and vegetable production is being supplied as raw product material to the revitalized plants. It is estimated that currently approximately 10-15 percent of the overall processing capacity is being utilized. The hope is for the sector's capacity utilization to increase through restoration of existing processing plants (many of them with machinery that is over 25 years old).

Exports of processed goods are fairly marginal compared to production and imports. For example, during FY2000, Armenia exported approximately 1,305 tons of tomato paste, 11.5 tons of processed vegetables, 915 tones of fruit juices, and 782 tons of preserves and jams. A large

proportion of the exports continue to target market in the former Soviet Union, and countries in the eastern bloc, such as Bulgaria.

Table 13: Total Fruit and Vegetables Export by Product and Country

Commodity	1997	1998	1999	2000	Exported to
In Metric Tons					
Fresh Vegetables	**1128.8**	**388.7**	**439.9**	**150.6**	
Eggplant, Bell Pepper, Mushroom, Spinach, Squash	46.3	39.5	42.6	24.6	Russia
Potato	*565.3*	*266*	*306.75*	*113.5*	Georgia
Onion, Garlic	5.2	4.5	4.7	4.8	Georgia
Fresh Fruits:	**955.8**	**1325**	**2950**	**4315.4**	
Apricot	315.6	398.3	1600	2400	Russia
Peach	156.3	226.5	335.6	665.3	Russia
Plum	48.6	65.3	85	125	Russia
Apple, Pear	125.3	198.6	250.6	380.5	Russia
Grapes	*289.3*	*423*	*543.6*	*650*	Russia

Source: Agricultural Development Center, Yerevan, Armenia, and September 2001.

Because of Armenia's relatively low domestic output but growing demand for processed food products, especially processed meats and dairy products, imports of these products have significantly increased. It is estimated that I 1998, 38 percent of these products originated either in the EU or the USA, while 29 percent were imported from Iran and Turkey (TACIS-2000). Iran and Turkey (despite border closures) continue to hold large market shares in the year 2000 as well,

Table 14 below provides the import data for vegetables and other items.

Table 14: Total Import of Fruit and Vegetables by Product and Country

Commodity	1997	1998	1999	2000	Importing From
	In Metric Tons				
Fresh Vegetables	**3815**	**1419.5**	**780.5**	**805.6**	
Tomatoes	136.8	83.5	46.48	75.6	Iran, Turkey
Cucumber	145.9	110.6	67.21	70.6	Iran, Turkey
Eggplant, Bell Pepper, Mushroom, Spinach, Squash	120.6	52.4	40.6	25.6	Iran
Potato (seed)	*780.6*	*650.8*	*437.55*	*456.3*	
Onion, Garlic	156.8	110.6	84.75	168.3	Iran
Fresh Fruits:	**11741.2**	**7851.4**	**10897**	**6056.1**	
Apple, Pear	450	380	450	230	Turkey
Figs	250	230	200	185.5	Iran
Grapes	*560*	*600*	*680*	*360*	Iran,
Pomegranate	449.6	313.5	350.4	350	Iran,
Banana	1350	950	1156.5	955.3	Iran, Ecuador, Columbia, Georgia
Citrus	7550	5197	7360.5	3960.8	Iran, Turkey, Georgia

Source: Agricultural Development Center, Yerevan, Armenia, and September 2001.

The Armenian processed food products market value is estimated at about $300 million (1999,TACIS 2000). It is apparent that food processing is growing into an important sub sector, a situation that is desirable since it adds value and creates additional employment and income.

Roughly 62 percent of the processed food market is supplied by domestic production, up from 44 percent in 1995, only 4 years (TACIS 2000). The Armenians have made significant strides leading to growth in this sector, which has contributed to the decline in Armenia's processed food deficit. However, a gap remains, and this gap is primarily maintained due to the sector's weakness in providing sufficient volume as well as sufficient diversity in product lines. Over one third of the demand continues to be supplied by imports, mainly from Iran and Turkey. A significant percentage of these imported products are largely filling gaps in the market. Armenia's production of processed products is still struggling to keep pace with the rise in quantity as well as range of products demanded by the domestic consumers. As such, imports are streaming in to meet market demand and offer variety to the Armenian consumer.

Sun Dried Tomato

Demand for sun-dried tomatoes is considered to be a product with growing demand. While there is a small amount of production ongoing in Armenia, quality of the output remains inconsistent. Once these shortcomings are under control and quality and safety can be assured, this product has a potential of providing opportunities for growth. Armenia should also look into diversifying product lines to take the best advantage of what it produces. For example, new products like tomato powder flakes are some that should be evaluated.

During April-2002 the ASME Project supported a major market survey in the Gulf States. Several areas were discovered to have opportunity in that area.

Some specific products include dried and dehydrated fruits and vegetables-especially apricots, peaches, apples, figs, and cherries, and sun dries tomatoes, (immediate possibility) for the consumer market. Dehydrated vegetables for the processing and manufacturing market are also possibilities.

While the team was unable to establish any contacts for dried vegetables, the traditional major use of this product is in the production of soups and noodle-based dishes. As the Gulf States increase their local production of processed foods, there should be opportunities for Armenia to build on its existing strengths in drying and dehydration techniques.

2. Fresh Market

Conventional fruits and vegetables pre-packs and fancy packs are some avenues for expansion. Again, given Armenia's natural resources, its dry climate, and low labor pool have potential for adding value to products already in production.

There is a demand for high quality selected fresh and processed vegetables in the Gulf States. Specific products include the following: fresh baby items: baby vegetables, fresh and dried herbs, for hotel, restaurants, and institutions (HRI); heirloom varieties of vegetables; dehydrated vegetables, specifically tomato.

J. CONSTRAINTS

1. Crop Inputs

Seed

The supply of excellent quality of seed for vegetables other than potato is a major problem. The majority of the seed available in Armenia is usually either locally produced under unknown conditions, or seed self produced under unknown conditions. The advice received during one site visit was that if a trialling effort is initiated, the seed must be imported, and controlled directly by the project or its client(s).

Fertilizer/Pest and Disease Materials

According to various estimates, Armenia optimally needs between 140,000-170,000 mt of fertilizer in pure nutrient per year, which translates into about 450,000-550,000 mt of finished product in physical weight. In the past 14 years, this calculated supply was achieved only in 1980. Since that time, supply has varied between a high of 124,000mt in 1986 to 4,000 mt in 1993 (equivalent to .2 kg/ha for cereals), while in 1999 state organizations imported 14,000 mt of only nitrogen fertilizers. No significant quantities of either phosphate, no potassium has been imported.

As a result of the conversations with some growers and their representatives, it was discovered that generally the nitrogen that was applied was done so during the fall plowing. One may wish to investigate this practice further because some of the nitrogen, as it is very mobile in the nitrate form, may be leached from the root zone prior to the planting season, reducing its value to the intended crop.

Armenia had only one fertilizer factory, producing nitrogen fertilizer in the form of urea. It was located in Kirovankan, just a few kilometers east of Spitak, the site of the 1988 devastating earthquake.

The factory was damaged to the point that production has not resumed. Over the last ten years, phosphorous and potassium fertilizers have not been imported into the country in large quantities. However, it has been discovered during this consultancy that there are some private individuals who are importing from other countries. Further, it is reported that there are no duties on the fertilizer as farmers use the product.

The fertilizer most commonly used is ammonium nitrate (33-34%N). The reported cost for the fertilizer is dram (ARD) 4,000.00 per 50 kg, or Dram (ARD) 80.00 per kg.

There are a few complex fertilizer mixes that are being imported into Armenia. They include di ammonium phosphate or 10-26-26, the cost is USD$156.00 per mt, 13-19-19 cost USD$176.00 per mt, ammophos 12-52-0 cost USD$176.00 per mt, ammonium phosphate 11-46-0 cost USD$176.00 per mt, and ammonium saltpeter 36% N cost USD$89.00 per mt. The rail delivery cost per mt from Russia is USD$90.00.

In the Soviet years, a unified agro-chemical service was operational in the country, the republican scientific production enterprise ‘Haygiugchemia’. In 1994, the enterprise was reconstructed into ‘Hayberriutium’, a corporation with 24-member organization, which was a regional ‘Berriutium’ joint stock company with various types of ownership. In 1997, by order of the Minister of Agriculture (MOA), the ‘Hayberriutiun’ corporation was dissolved and instead the ‘Hauberriutium’ holding state enterprise was created, which was later renamed ‘Agrochemia’ state enterprise. The newly created enterprise is the full owner of 34 percent of state shares in enterprises of the ‘Berriutiun’ system. It’s goals and objectives are the following;

Organize and implement measures for combating pests, diseases and weeds of agricultural crops;
Import and market chemical substances for plant protection and fertilizers;

Organize and conduct activities aimed at increasing the fertility of the land.

In 1990 about 1,200 mt of pesticides were imported into the country, while in 2000 the amount was 112 mt, some according marz officials and local farmers was of questionable value. The most seriously affected crops are grapes, fruit trees, and vegetables.

Over the past ten hears, phosphorus and potassium fertilizers have not been imported into the country.

2. Cold Storage and Cold Chain Constraints

The lack of cold storage facilities at the airport is a major hurdle to the development of successful cut flower, fresh fruit, and vegetable or of any perishable export program or for the fresh market.

Further, the lack of cold storage and hydro cooling facilities at the farm/production level inhibits a wide range of crops that could be successfully exported. Cooling as soon as possible after harvest is a must for many crops so to re-move the field heat from the product. Delays have serious consequences on product quality.

During one site visit a system for storing apples was observed. The cold room utilized old farm building.

The new company has just completed its first year of operation. During year one they stored at total of 35 mt of apples the their two separate chambers, 15 mt in one and 20 mt in the larger chamber. Chamber one is about 15'X 40' the second is slightly larger

The building was is an old farm structure that has been converted. Each chamber was insulated with Styrofoam, that is 5 cm thick. The walls of the structure are an additional 60 cm in thickness. This provides reasonably good insulation. No humidity control is possible with this facility. They could try placing pans of water on the floor that may be helpful.

The last of last season's apples were sold in mid-April-2002.

The 2002 plan is to store 120 mt of apples. The company is planning to expand their facility to accommodate the larger quantity. They plan to store only apples in the 2002 season.

Another lesser-cost means of supplying more cold room space is the possible use of retired refrigerated vans, the types used for either overland transportation or those used for ocean transportation. Vans, without refrigeration in California cost about USD$3,000.00 delivered, for a 40' unit. They are generally available also in 20' lengths. This may be worth some time.

3. Mechanical

Tractor numbers declined from more than 15,000 in 1986 to about 12,500 in 1993; the country still has about 2.5 tractors per 100 hectare hectares of arable land, which could be considered as more than adequate. The most difficult part of the problem is the increasing age of the fleet and the difficulty faced in obtaining the necessary spare parts.

The Former Soviet Union (FSU), agricultural equipment was manufactured for extensive farming. With generally new farming structure, these tractors and ancillary equipment is unsuitable for small mixed farming. Farmers attempt to overcome this problem by blocking adjoining land, particularly

for cereal production. Particular problems arise with grapes and vegetable holdings and harvesting of small lots.

About ten percent of the farms own tractors or mini-tractors. Despite the psychological apathy towards the previous cooperative system, about half of the farmers cooperate in the use of farm machinery and sale of product. Even with the general positive evidence of cooperation, farmers have not yet formalized these relationships or considered group ownership of farm equipment.

Assuming that the development of alternative crop activity moves forward, during the initial phase every effort will be made to accomplish the goals by utilizing existing equipment that is in the country. However, if this program continues into a full commercial activity, there will be a need to further evaluate the equipment needs and very likely additional equipment will be required to keep the growers completive with other producing areas.

4. Field Support Services

There is a pressing need for the introduction and testing of a range of new and previously grown crops. This implies that a zonal approach will be necessary and that the work should largely be carried out on farmers' fields to act also as a demonstration for the larger good.

The development of appropriate technology would enable farmers to reduce their costs, increase yields, and improve quality and diversity of production. Both public and private benefit would ensue, the latter already in evidence among a core group of more knowledgeable farmers. A stimulus is required which would engage the farmer in constraint analysis and technology development, better employ the often under-utilized field support resources to address identified needs and increase client accountability.

It will be the recommendation of this consultant that if this alternative crop development effort is initiated, that the necessary field support services be housed, and supported by the individual processor(s) in each trialling area.

5. Crop Losses

Production of vegetables is quite impressive, but industry experiences crop losses through lack of cold chain facilities and storage, timely collection and marketing points and transport. This results in unnecessary losses at the farm level and throughout the market chain. A lot in some peoples view could be achieved through the formation of growers' and market associations, through which better farm gate prices could be achieved and basic primary marketing facilities financed.

The structures of the estimated yield losses, according to the expertise assessments, indicate the following loss levels:

Diseases and pests- up to 30%
During transportation and sale- up to 10%
Inadequate storing and boxing conditions- up to 25%
As a result of the late or irregular application of irrigation water- up to 15%
As a result of the quality of seeds- up to 20%

Farmers use varieties of seed of both domestic and foreign origin. Armenian varieties are known for their good taste; however, they have low resistance to diseases and pests. Further, they do not posses acceptable shelf life in general.

The development of the production of vegetables seed crops depend on the introduction of intensive cultivation techniques, advanced technologies and management systems, and;

Upgrading the processing industries
Development of hybrid seed production
-Ararat Valley (tomato, cucumber, onion)
-Shirak marz (beetroot, cabbage, cauliflower)
-Ararat marz (watermelon, melon)
Rehabilitation of the irrigation systems

6. Irrigation Systems

Irrigated farming in Armenia is concentrated in the Ararat Valley. Because of the high level of underground water and their low quality in some area, open and closed drainage systems have been constructed on about 30,000 ha of these areas. The enterprise responsible for this drainage system was created in 1998. It is charged with controlling and monitoring the level of underground water, as well as the quality of the irrigated lands. There are 145 km of primary drainage canals, 263 km of secondary open channels, covering 16,300 ha of land, and 126 km of secondary closed drainage networks for an additional 8,000 ha of land. There are 61 deep wells for 6,100 ha, 176 artesian wells for 5,500 ha, and 12 pumping stations for 9,100 ha of land.

Irrigated farms are generally smaller, 1.38 ha compared to 3.17 ha for non-irrigated farms. Comparative performance from a survey conducted in 1992* indicate that the per hectare returns of US$440, compared to US$140 from non-irrigated land. Overall, about 70 percent of the production comes from irrigated holdings.

While the current system is not of the appropriate scale and design for the new farming size, there is sufficient area that can be irrigated in all of the marz that were visited during this consultancy.

*Armenia's Private Agriculture, 1988, EU/World Bank

7. Transportation

Transportation cost is a key issue for Armenia. Presently, virtually all products go through Georgia to outside markets. Improvements in the efficiency, economies of scale, and collective chartering will lead to improved freight rates and a reduction in unit transport costs. Further more, current Armenian freight forwarders assure that transport cost will be reduced by at least 25 percent when the borders with turkey open, and traditional trade routes are freely accessible to Armenians.

K. CONCLUSIONS

A major requirement of this consultancy was to visit as many of the production area as possible in Armenia. Eight of the nine marz were visited, this allowed for exposure to the majority of Armenia's climatic zones. In general, the climate during the vegetable production season in Armenia are very similar to that found in the mid central valley of California. However, it should be noted that the spring and fall seasons in Armenia are cooler compared to that in California. During the summer season they are identical during some months. The rainfall data indicates that there not sufficient rainfall during the major production season to eliminate the need for irrigation. While Armenia receives more rainfall during the fall and spring seasons, it is not adequate for crop

production.

During this consultancy, the major criteria for alternative crop development have been investigated. The factors include climatic data, input availability (seed, transportation, equipment, irrigation, fertilizer, and pest/disease control materials), market outlets, presence of the necessary processing infrastructure, and cold storage facilities. Cold storage from a fresh market vegetable production point of view may well be the most serious of all constraints. While serious enough for this report, as processed form of vegetables is the intended target it is not as serious as for the fresh market industry.

While complex fertilizer is not readily available Armenia or used by the local farmers, it is available in the country or can be imported from either nearby countries (Georgia and the Ukraine) or from Holland. The primary commercial fertilizer used in Armenia is ammonium nitrate; it is applied at the rates of 300 to 500kgperha. One problem area is that the fertilizer is usually applied during the fall plowing period. It is recommended that this be evaluated as the rainy season may be leaching a substantial quantity of the nitrogen from the root zone. There are no duties on the fertilizer if used by the farmers and not re-sold.

Seed quality is another major issue in Armenia. The best advice received was if you plan to conduct any production activity, maintain control of the seed source directly. This can be more closely evaluated if the trialling program proceeds. The best crops that were observed were planted using seed from either Holland or Israel. Several of the seed catalogues that are being left are Dutch companies.

All of the seed observed in local markets was of unknown source and quality.

Cold stores and cold store chains are basically non-existent in Armenia. One site was visited that had constructed a cold room used for apple storage but that is essentially the extent in Armenia. This constraint would be a project stopper in any fresh market development program however, as this SOW is intended primarily for processed foods, the constraint be manageable. Any trialling site(s) must be kept as close to the processing facility as possible.

L. RECOMMENDATIONS

If the decision is made to move forward with an identified client and initiate a crop trialling program, the following specific recommendations are made:

1. All of the crop development activity should be done in cooperation with defined processor client(s). The client, with the projects support, should take the lead in all operations, including seed orders, fertilizer, pest/disease control products, field extension support, transportation to and from the fields, and appropriate field harvest containers. An illustrative example of how this could be structured is located in the annex.

2. The processor client(s) will provide the selected growers with a mutually agreed growing contract, that specifies required crop quality, raw product delivery time line, and agreed to purchase price (per unit, kg/mt) to the farmer. Further, it is recommended that the selected processor client(s) prepared written quality standards for the targeted vegetables, and that the standards become part of the agreement with the farmer(s).

3. During the start-up, due to lack of adequate cold storage, it is recommended that any trial

locations be established as close to the processing facility as possible. This will help to minimize crop damage, due to field heat and transportation damage.

4. Before any implementation is under taken, necessary farm level extension materials must be prepared and be translated in Armenian. They should be written for the farmers, and their education level.

5. Time is very important if there is any desire to initiate any trialling during the 2002 production season. Many components have to be coordinated and probably a best-case scenario would be for some possible trial for a fall harvest. A time line section follows with more detail. Precise planning is not possible until a basic direction is decided and thereafter if there is to be a program the necessary client(s) be identified.

6. During this consultancy it has been observed that the ASME Project appears to be designed primarily as a market directed and motivated one. One would suspect that their interest in the alternative vegetable area would be that it would assist the project in achieving it's required goals and objectives, rightly so. However, should the project move forward and implement a trialling program for new vegetables crops, it is my opinion that additional technical support to the existing staff will be required. The desire is to motivate the local processors to assume the leadership role in moving this activity forward.

M. IMPLEMENTATION STRATEGY AND TIME LINE

Phase 1

Given the timing currently being faced, and created by the abnormal weather this season, the following time line could be considered. The crops that will be trialled will ultimately be determined by three factors; first the selected client(s), secondly the actual timing of trial start up, and third, selected location of the trials. The recommendation would be that most probably the trials would be best suited to the Ararat Valley, given the likely timing. Further, it would be recommended that a larger number of crops be trialled than you might think necessary. This is really a learning experience for all involved.

Task	Task Completed	Implementation
Follow-up discussions, project and other appropriate party (ies)	May 16-June 10,2002	June 1-10, 2002
Identify cooperator(s) and select the initial crops for phase one, the required field staff support by the client to be included	June 10-15, 2002	June 10-15, 2002
Identify and make arrangement for the necessary inputs with appropriate person(s)	June 10-15, 2002	
Complete the necessary printed extension materials for the field support staff(some drafts are ready.	June 25, 2002	

Complete client agreement, identify trial area(s) and grower(s)	June 20-25,2002	
Complete grower agreement(s)	June 20-25, 2002	
With selected cooperator(s) install the first trial planting(s)		July 1, 2002
Ongoing field monitoring, everyday initially if possible, depending on the number of sites and distance from each other.		Continual
At crop maturity, harvest and make yield and quality determinations. If possible, the processor/client can use the some of the product for trial processing and marketing activity.	September, 2002	September-crop completion

Phase 11 2003

The trialling program would of course build on the lessons learned in 2002. Additional crops could be added and possibly some removed from the program if it is determined that they do not fit the marketing need.

It is anticipated that additional client would be added, making it necessary expand the trialling program into other locations.